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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LEE, HSIEN MING

ART UNIT PAPER NUMBER

2823

DATE MAILED: 11/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/626,212

Applicant(s)

POMAREDE ET AL.

Examiner

Hsien-ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-10 and 12-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-10 and 12-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE
PRIMARY EXAMINER

11/16/04

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 111604.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Applicant's cancellation to claims 1 and 11 is acknowledged. Claims 2-10 and 12-19 are pending in the application.
2. The indication of allowable subject matter is withdrawn in view of newly discovered prior art.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 2-5, 7-10 and 12-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Sneh et al. (US 6,551,399).

In re claims 7 and 9, Sneh et al., in Figs. 8-10 and related text, teach the claimed method of depositing a film (i.e. layer 15) over a surface (i.e. a surface of a dielectric film 14) in a partially fabricated integrated circuit, comprising:

- exposing a top surface of the dielectric film 14 to a NH₃/H₂/N₂ plasma (col. 6, lines 51-55), thereby modifying termination of the surface by creating ample termination sites 19 (Fig.9) without significantly affecting bulk properties beneath the surface, wherein the termination sites 19 would activate the surface of the dielectric film 14,

which, in turn, would be beneficial to the adhesion of the subsequently formed film;
and

- after modifying the surface termination, depositing a metal oxide layer 15, such as Al_2O_3 (col. 5, lines 6-7), thereover using an atomic layer deposition process (col. 6, lines 55-60), wherein the atomic layer deposition process comprises a metal oxide (i.e. Al_2O_3) deposition.

In re claims 2 and 12, Sneh et al. teach that the $\text{NH}_3/\text{H}_2/\text{N}_2$ plasma (col. 6, lines 51-55) comprises a nitrogen-excited species.

In re claim 3, Sneh et al. teach that the surface of the dielectric film 14 overlies a semiconductor substrate 10.

In re claims 4, 5, 14 and 15, Sneh et al. teach that the atomic layer deposition comprises depositing an oxide, such as Al_2O_3 (col. 5, lines 6-7), having a higher dielectric constant than silicon nitride.

In re claims 8 and 17, Sneh et al. teach that the plasma is generated remote from the surface since it uses remote plasma process (col. 9, lines 9-10).

In re claim 10, Sneh et al., in Figs. 8-10 and related text, teach the claimed method of depositing a film (i.e. layer 15) over a surface (i.e. a surface of a dielectric film 14) in a partially fabricated integrated circuit, comprising:

- exposing a top surface of the dielectric film 14 to a $\text{NH}_3/\text{H}_2/\text{N}_2$ plasma (col. 6, lines 51-55), thereby modifying termination of the surface by creating ample termination sites 19 (Fig. 9) without significantly affecting bulk properties beneath the surface, wherein the termination sites 19 would activate the surface of the dielectric film 14,

which, in turn, would be beneficial to the adhesion of the subsequently formed film;
and

- after modifying the surface termination, depositing a layer 15 thereover using an atomic layer deposition process (col. 6, lines 55-60), wherein the atomic layer deposition process comprises two reactant pluses with intervening purge pulses in each cycle, i.e. comprises two precursors alternatively being introduced with a carrier gas purge in between each cycle of the introducing (col. 13, lines 1-9).

In re claim 13, Sneh et al. teach that the surface of the dielectric film 14 is defined by a semiconductor substrate 10.

In re claims 16, 18 and 19, Sneh et al. further teach the claimed method, comprising:

- exposing a top surface of the dielectric film 14 to a $\text{NH}_3/\text{H}_2/\text{N}_2$ plasma (col. 6, lines 51-55), thereby modifying termination of the surface by creating ample termination sites 19 (Fig.9) without depositing greater than one atomic monolayer of the products of the plasma on the surface (col. 3, lines 49-53); and
- after modifying the surface termination, depositing a metal oxide layer 15, such as Al_2O_3 (col. 5, lines 6-7), thereover using an atomic layer deposition process (col. 6, lines 55-60), wherein the atomic layer deposition process comprises a metal oxide (i.e. Al_2O_3) deposition, wherein the atomic layer deposition process comprises two reactant pulses with intervening purge pulses in each cycle (col. 13, lines 1-9).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sneh et al. (US '399) in view of Sneh et al. (US 6,503,330).

In re claim 6, Sneh et al. teach the claimed method of depositing a film (i.e. layer 15) over a surface (i.e. a surface of a dielectric film 14) in a partially fabricated integrated circuit, comprising:

- exposing a top surface of the dielectric film 14 a NH₃/H₂/N₂ plasma (col. 6, lines 51-55), thereby modifying termination of the surface by creating ample termination sites 19 (Fig.9) without significantly affecting bulk properties beneath the surface, wherein the termination sites 19 would activate the surface of the dielectric film 14, which, in turn, would be beneficial to the adhesion of the subsequently formed film; and
- after modifying the surface termination, depositing a layer 15 thereover using an atomic layer deposition process (col. 6, lines 55-60).

Sneh (US '399) et al. do not expressly teach the exposing step incorporates less than 10 atomic % of the products of the plasma at a depth of greater than about 10 Å from the surface.

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Sneh et al. (US '330), however, in an analogous art, suggested that using plasma for modifying the surface termination would involve a formation of self-saturated layer; and the thickness is dependent upon the material to be modified (col. 6, lines 62-67).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to recognize that by routine optimization using a desired atomic percentage of the products of the plasma in the method of Sneh (US '399), a desired depth from the treated surface can be expected, since it is material dependent.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-ming Lee
Primary Examiner
Art Unit 2823

Nov. 16, 2004

HSIEN-MING LEE
PRIMARY EXAMINER

He
11/16/2004